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Interstate Business Tax Differentials and New Firm Location: Evidence From Panel Data

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This paper examines the impact of state and local tax differentials on the location of industry using a panel data set of manufacturing firm start-ups. The number of firm births is modeled as a Poisson count process and the estimation techinique explicitly accounts for unobserved location or state heterogeneity in the estimation. A second focus of the analysis is the development of an industry and year specific series of effective tax rates for each state. After controlling for state and industry effects, the estimates indicate that a high state marginal effective tax rate reduces the number of firm births for most industries examined.

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1. Introduction

The impact of inter-jurisdictional tax differentials on the location of industry is a controversial issue in the academic, business, and public service communities. Business tax incentives are widely employed by state and local governments in the pursuit of economic development objectives. The incentives range from conventional investment tax credits to lower the costs of purchase or construction of new plant and equipment (23 states) to property tax abatement programs for the partial or total forgiveness of the tax on eligible property for a stipulated number of years (31 states).[1] Since few states maintain a complete tax expenditure budget, the actual cost of these programs is unknown. Perhaps for this reason, and because tax rates and incentives are among the few elements of business climate over which a state government has control, they remain an extremely popular political tool of state governments.

Despite their widespread use, the efficacy of these policies in attracting industry remains unclear. Empirical evidence of two types -- surveys and econometric analysis -- has yielded mixed results. In most surveys of company executives, in spite of a consistent and strongly maintained public position that business taxes and tax incentives are a major impediment to economic development, business taxes are rated either a "moderate" or "insignificant" influence on location.[2] Insufficent data on the location or movement of actual firms have traditionally limited econometric analyses to aggregate studies of new capital investment, or

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[1] See Ledebur and Hamilton (1986) for a comprehensive overview of the extent of incentives offered by state governments.

[2] See Kieschnick (1980) for a review of survey evidence and the details of a 1980 survey of Fortune 500 executives involved in recent location or expansion decisions.

changes in state employment or personal income. This literature is extensive; reviews may be found in Carlton (1979) and Wasylenko (1990). These studies generally find little evidence of a tax effect.[3] More recent studies with establishment level data in Carlton (1979,1983) and Bartik (1985,1986) have examined the location choice cross-sectionally in a multinomial choice (MNL) framework but have not altered earlier conclusions. For several reasons, however, these earlier estimates may not be accurately reflecting the influence of taxes on industrial activity. First, without data on firm characteristics, the applicability of a choice-based model is limited. Second, MNL is not well suited to choices across states for which unmeasured attributes are highly correlated.[4] It is well known that the IIA property imposed in this context biases the results. Third, as has been established in the public finance literature, measuring the level of business taxes with a single nominal rate will not capture the effective tax rate facing a firm.[5]

The purpose of this paper is to examine the impact of state and local tax differentials on the location of industry by exploiting the natural laboratory created by the federal system - states differ with respect to tax burdens across time as well as between states - to analyze the effects of taxes on firm births in the presence of unobserved state heterogeneity. A reduced form Poisson count model is estimated both with and

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[3]An exception is Helms (1985) who finds a relationship between personal income growth and tax and expenditure variables.

[4]Bartik (1985) estimates a "nested" logit model - allowing regional random effects correlated with state characteristics - but the Census regions contain vastly differing states (e.g., Maine and Massachusetts, Texas and Arkansas, California and Oregon) which suggests that this technique will not adequately capture state variation.

[5]See, for example, Bradford and Fullerton (1981) and King and Fullerton, 1984.

without controlling for unobserved state heterogeneity. A second focus of the analysis is the development of an industry and year specific series of effective tax rates for each state. The research will indicate, abstracting from state effects, which economic factors, including taxes, influence the location of industry.

The results show that different industries are not attracted and repelled by the same set of state characteristics. However, after controlling for state and industry effects a high state and local marginal effective tax rate reduces the number of firm births for most of the industries examined. The estimates presented demonstrate that accounting for unobserved state heterogeneity is critical to accurate measurement of the response of activity to measured state characteristics. Thus, previous analyses that do not control for this heterogeneity omit an important component of location choice, which may bias the results.

This paper is organized into five parts. Section 2 describes the econometric model to be estimated. Section 3 describes the data on firm births and the derivation of the effective tax rate series. Other state characteristics used in the analysis are also discussed. Section 4 reports the econometric results and their implication for industry location, while section 5 contains concluding remarks.

2. Econometric Model

The count of births is modeled as a Poisson distributed random variable. The likelihood of observing a count of births n_{jt} (suppressing the industry subscript i) in state j in year t is

$$f(n_{jt}) = \exp(-\lambda_{jt})\lambda_{jt}^{n_{jt}} / n_{jt}! \qquad (1)$$

The expectation of n_{jt}, λ_{jt}, is parameterized by:

$$\lambda_{jt} = \exp(X_{jt}\beta), \tag{2}$$

where β is a parameter vector to be estimated and X_{jt} is a vector of observable state characteristics which influences profits.

The log likelihood for this model is

$$L(\beta) = \sum_j \sum_t (-\log (n_{jt}!) - \exp(X_{jt}\beta) + n_{jt}X_{jt}\beta). \tag{3}$$

While the likelihood is constructed under the Poisson assumption, this specification is robust with respect to distributional misspecification. Gourieroux, Monfort and Trognon (GMT, 1984) have shown that the parameters β are consistently estimated provided the conditional mean (2) is correctly specified; the Poisson assumption need not be correct. If the Poisson assumption is correct, the estimators are efficient.

This specification, however, does not allow for locational heterogeneity with is either unobservable or, for other reasons, difficult to measure. Factors such as climate, labor force work ethic, and proximity to academic institutions may be important influences on firm location. States which border on a coast may have different transportation possibilities than a land-locked state, for example. These factors will influence both the type and number of births in a state. Hausman, Hall and Griliches (1984) (hereafter HHG) extend the Poisson model to allow for heterogeneity using Anderson's (1972) conditioning maximum likelihood technique.

Following the fixed effects approach outlined in HHG, each state is allowed to have its own propensity to attract births by conditioning separately the count distribution of each state on the sum of births for the whole period. This is conceptually equivalent to the "within" estimator,

i.e., including dummy variables, in the linear case.[6] If the n_{jt} are independently distributed Poisson, then $\sum_t n_{jt}$ is also distributed Poisson with parameter $\sum_t \tilde{\lambda}_{jt} = \alpha_j \sum_t \lambda_{jt}$. The log likelihood function of this model up to an additive term is

$$L(\beta) = \sum_j \sum_t n_{jt} \log \sum_{s=1}^{T} \exp[-(X_{jt} - X_{js})\beta].$$

3. Data Description

The data comprise a cross-section time series panel of 22 states and five manufacturing industries (at the 3-digit SIC level) from 1975-1982.[7] Two variables deserve special comment. The count of plants has not been previously analyzed in empirical work and its derivation is discussed below. This is followed by a brief discussion of the tax rate series, another innovation in this literature. The remaining variables are standard in the literature and are briefly discussed.

<u>Firm Births</u>

New plant births are calculated from the U.S. Establishment and Enterprise Microdata File (USEEM) of the Small Business Administration (SBA). USEEM was developed as part of the Business Microdata Project by the Brookings

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[6] Some state characteristics may change over time. Over an eight year period, however, a priori reasoning suggests that the state effects which influence the pattern of firm births may be modeled as if they were constant. Secondly, the earlier illustrations of potential fixed effects demonstrates that they are unlikely to be independent of the X_j's. It is assumed that the functional relationship between attributes X and firm births is the same in every state, i.e., β is the same.

[7] These states were currently available in the simulation model used to measure business taxes. They comprised 65 percent of manufacturing employment in 1975. See Papke (1989) for further discussion.

Institution for the SBA between January 1980 and November 1983. The USEEM file consists of four cross-sectional data sets which can be linked longitudinally across firms. This is the first federal agency microdata base representing the entire U.S. business population with paid employees. Available for 1976, 1978, 1980 and 1982, the USEEM files included a total of 8.3 million businesses which existed at some point from 1976 to 1982. Each observation is an establishment; many establishments may comprise an enterprise. Information on each establishment includes an identification number, industry code (four digit SIC), location (state and county), employment, organizational status (independent, branch, subsidiary, or owner of other establishment in a multi-establishment firm) and the age of the report. Observations for all establishment types except branches include the age of the business and frequently, its annual sales.[8] If the business is not independent, the observation includes information on the enterprise to which it belongs -- the aggregate employment size class of the firm, the major industry in which its employment is concentrated, the state location of its owner and whether the firm is a single or multistate operation.

The USEEM data base originates from the Dun and Bradstreet (D&B) Duns Market Identifier file (DMI). D&B is a credit checking agency which collects primarily credit related data on establishments but which maintains records on firms which need insurance or legal assistance as well as credit. D&B claims that its coverage of the population of U.S. manufacturing firms is quite high and frequently exceeds estimates made by other sources such as _County Business Patterns_ or state departments of

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[8] Both Bartik and Carlton examine the location of branch plants. In the construction of the USEEM, however, the date of branch plant births was ommitted. The present study is therefore limited to the counts of independent plants.

employment security. Three quarters of businesses are reported to appear in the DMI file during their first three years of existence. The remaining 25 percent tend to have small sales, and are primarily family financed sole proprietorships in industries with little need for credit or insurance. Small manufacturing firms, however, are well represented in the DMI file because they usually pose some credit risk.

There are two limitations of these data. First, some plants may be omitted. D&B maintains this bias does not affect the accuracy of the manufacturing information since most manufacturing plants require some type of credit or insurance. In addition, a plant has eight years to appear in this extract of the USEEM file. Given the nature of the process, however, the count of births in the later years is apt to be less complete than the earlier years. In addition, the USEEM reports are biennial so that any firm that is born and dies within a two year period may be missed entirely.[9] Second, as a consequence of the D&B identification method, a plant which changes ownership is counted as a new birth. The resulting count is not, therefore, the net change in births. Since the DMI is the most complete source of current microdata on U.S. businesses with employees, it is not possible to estimate the magnitude of these errors. Instead, these potential biases are controlled for in the estimation procedure.

The SBA limited the sample to five industries; I imposed two criterion in their selection. First, the industries could not be tied to their location by either demand or supply factors. That is, the industries must be "footloose," not dependent on a particular location for an input and they

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[9] Note that the count is a gross measure of plant openings. Of related but separate concern is the net change in births of plants which remained in existence for some arbitrary length of time. A model of that phenomenon is of great interest but beyond the scope of the present paper.

must produce output to serve a national market. Additionally, there must be differing degrees of birth activity over the time period.

The five 3-digit Standard Industrial Classification (SIC) industries selected are: Women's and Misses' Outerwear (SIC 233), Household Furniture (SIC 251), Book Publishing and Printing (SIC 273), Communication Equipment, Including Radio and TV (SIC 366), and Electronic Components and Accessories (SIC367).

Table 1 displays the state by state count per million persons for the sample period 1975-1982.[10] The industries differ with regard to the absolute number of births - Apparel has the greatest number, suggesting that entry into this "highly competitive" industry is relatively easy or demand is growing faster. There are also differences in the distribution across states for a single industry. Furniture births are slightly more evenly distributed across the states; birth activity in Apparel, Publishing, and Communication Equipment is greatest in a few states: California, Florida, New Jersey and New York. Electronic Components has the fewest number of births with little activity occurring outside of Massachusetts and California.

Effective Tax Rates

Measuring the incentive effects of capital taxation is complicated by the imposition of taxes on different kinds of income, at different rates by federal, state and local authorities. Moreover, because of the complexities involved, inflation, corporate financial policy, investment tax credits, depreciation allowances and the effects of uncertainty, an overall measure of "the" capital income tax is a difficult exercise. For these reasons, the nominal state corporate income tax rate, most common in

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[10] The absolute number of births is scaled to provide some notion of relative size of activity across states for the purposes of Table 1 only.

this literature, is not an accurate reflection of the layers of taxes and tax provisions which form the ultimate effective tax rate facing a firm. To abstract from these complexities, policy makers employ a summary statistic - the effective tax rate (ETR). A review of the various types of ETRs (average versus marginal) is provided in King and Fullerton (1984). This paper employs a simulated ETR which is state, industry and year specific and which has been employed in recent empirical work (Papke, 1987). A brief overview of the simulations is given in the Appendix to this paper. Table 2 presents selected ETRs, calculated with and without the Federal tax system.[11]

The first series is the combined ETR of state and local taxes only, while a second series adds the Federal tax burden (as well as the deductibility of state and local taxes from the Federal tax). The presence of Federal deductibility dampens the interstate variation in ETRs but differences remain.[12] For example, for the Apparel industry, the ETR for state and local taxes only ranged from 6.38 in Texas to 19.05 percent in Wisconsin in 1975. The combined ETR (series B) ranges from a low of 59 percent in Texas to 67.24 percent in Wisconsin.[13]

Along a second dimension, the marginal ETRs are generally higher in the Apparel industry than in Communication Equipment. This reflects differences in the asset structure of these two industries. For example,

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[11]See Papke (1989) for a discussion of the construction of ETRs.

[12]The combined Federal, state and local tax rates (series B) fall over the period 1975 to 1982 (the maximum Federal corporate income tax rate was 48 percent from 1975 to 1978, and 46 percent from 1979 to 1982).

[13]The AFTAX calculations assume the statutory Federal corporate income tax rate. There is no explicit treatment of firms with tax losses to be carried forward or backward.

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machinery and equipment comprise roughly seven percent of total assets in Apparel but average 11 percent in Communication Equipment. Thus, investment tax credits will differentially benefit Communication Equipment firms.

Other State Characteristics

Wages and energy costs are key determinants of industrial activity, especially in the well-publisized movement to the Sunbelt. The average hourly earnings in dollars of production workers by SIC and by state are from Employment and Earnings: States and Areas 1939-1982, Bureau of Labor Statistics. The state wide energy series is the industrial sector average cost in dollars per million BTU's by state from the State Energy Price and Expenditure Report (1970-81, 1982) of the Energy Information Administration. This sector includes mining, manufacturing, construction, agriculture, fishing and forestry.

Aside from taxes, state (and local) governments may influence business activity with a variety of public services which directly or indirectly benefits business and its employees. This spending may be out of own source or Federal revenues. Business location publications, such as the Site Location Handbook claim that publicly provided business amenities are critical to an overall favorable business climate in a state.[14] All local government expenditures on police and fire protection in dollars per capita from the Bureau of the Census State Government Finances were used to indicate levels of services to business.[15] A second policy instrument, small issue

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[14] Industrial Development, Conway Publications, Atlanta, Georgia.

[15] This includes intergovernmental transfers of revenue to be received and distributed by the local governments. Empirical evidence (Ladd, 1975) suggests that owners of local industrial property do distinguish between

industrial revenue bonds (IRB's) is included as a service directly targeted to business. Small issue IRB's are tax-exempt bonds that state and local governments may issue to provide financing for private firms. Interest income from bonds is exempt from Federal taxation; this enables businesses to borrow funds at below-market interest rates. In effect, with IRB's, a government issuer can transfer its tax-exempt status to a private borrower.[16] Since states may authorize these issues at little cost to themselves, this policy tool should be a good indicator of a state's attitude toward business development.

As an input to production, the local price of land is included in a firm's profit function. In addition, a land price series is central to identifying tax effects over and above those taxes previously capitalized into land values. An industrial land price series was not available, so an alternative series, the price in hundreds of dollars per acre of farm land was constructed from the U.S. Department of Agriculture's "Farm Real Estate Market Development" Publications CD-62 through CD-85. Land area in thousands of square miles was included to control for the state size and to provide a test of the so-called "dartboard theory" in location analyses, namely that a 10 percent increase in land area (potential sites) in a state leads to a 10 percent increase in the number of births. State population in millions was included as a first attempt at controlling for state heterogeneity and to account for the "potential entrepreneurial pool," an important consideration

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local expenditures which benefit business, and those which disproportionately benefit residents (e.g., education, transfer payments). Substitution of expenditures on education did not qualitatively alter the results.

[16] States vary considerably in their IRB use. See Papke (1989) for details. The index is constructed for the ratio of issues to the sample average issue.

in earlier work (Carlton (1979), Bartik (1985)).[17]

Year dummies, relative to the base year 1975, are included to account for general movements in the economy.[18] In addition, the time dummies will absorb the declining count nature of the measurement error in the dependent variable. All variables were deflated by the Consumer Price Index where appropriate.

4. Empirical Results

The results of the estimation on the pooled sample as well as industry subsamples are presented in Table 3. The data strongly rejected pooling in a likelihood ratio test with a statistic of 2305.58 (the critical value of the chi-square statistic at the one percent significance level is 4.6). Each subsample contains 176 observations.

There is considerable inter-industry variation in the effects of the

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[17] Another measure of entrepreneurial pool, production worker hours in manufacturing, has been used to proxy for agglomeration economies. For the purposed of this model, if one believes that agglomeration economies are reflected in an established manufacturing base in the state, the fixed effects estimates in the second model will account for them. If, on the other hand, one believes the process of attracting firms via agglomeration is a dynamic process then time dummies will absorb part of this effect (if the impact is the same across states).

[18] Note that for a two dimensional panel, the conditional maximum likelihood estimator can only be performed over one dimension. Thus, I employ time dummies to account for time specific effects. While the cross sectional dimension of the panel is large enough to estimate time dummies consistently, a natural extension of the state fixed effects model is to double condition the likelihood on both time and state effects. That is, in addition to a state specific fixed effect α_j there is a time specific η_t in the specification of the conditional mean. Under these circumstances, the model becomes

$$n_{ijt} = \exp(X_{ijt}\beta + \alpha_j + \eta_t + \epsilon_{ijt}).$$

This extension of the HHG derivation is derived in Papke (1989).

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economic variables on birth rates. The effective tax rate (ETR) is negative and statistically significant in three out of five industries. In this specification, the economic effect of a tax change is second only to the influence of a wage change. A one percent (100 basis points) increase in the ETR (from 50 to 51 percent) leads to a 26 percent decline in Apparel births, an 8.8 percent decline in Publishing births and a 3.2 percent decline in births in Communication Equipment. These three industries are generally thought to be highly competitive and in fact, these industries have the largest number of "correctly signed" coefficients in this specification. The ETR is positively related to both Furniture and Electronic Component births. While there is substantial inter-industry variation in the responsiveness of firm start-ups to business taxes, a statistically significant and sizable elasticity is found for several of the industries.

The wage coefficients reflect the composition of the input costs and have the largest economic influence of the remaining variables on location. The coefficient is negative in four out of five industries, and it predicts that a dollar an hour increase in the wage in each industry leads to a 98 percent decline in Apparel births, a 66 percent decline in Furniture births, a 13 percent decline in Publishing births and an 18 percent decline in births in the Communication industry.

In general, the economic effects of business services, land price, business climate, taxes, wages and energy costs generally have the predicted sign in the Apparel, Publishing and Communication Equipment industries. The Furniture industry is partially responsive to state characteristics. The results with the Electronic Component industry suggest that the births of firms in this industry are unresponsive to the

economic factors described here.[19]

Recall that the basic Poisson specification is correct if there are no unobservable factors which influence firm births and which are correlated with the explanatory variables. A priori, this assumption seems too restrictive -- there is much evidence of state heterogeneity too complex to capture in a few price variables. A specification test is performed by comparing the Poisson estimates to those from nonlinear least squares.[20] The critical value of the F statistic at the 99 percent level is 2.04. All five industries reject the initial Poisson specification with F statistics of 22.34 for Apparel, 24.81 for Furniture, 3.078 for Publishing, 5.051 for Communication Equipment and 6.031 for Electronic Components. This is not surprising since there is a suspicion that some unobservable state characteristics must be correlated with both births and explanatory variables. Under this circumstance, estimation of the Poisson model produces inconsistent estimates.

The Fixed Effects or "within" specification was estimated and results reported in Table 4. Recall that the fixed effect or conditional likelihood technique in a nonlinear model is analogous to differencing in a linear model. The resulting coefficients on the economic variables are effects abstracting from unobservable state differences in the propensity to host firm births. Note that the time invariant variables - land area and the constant term - drop out of this second specification. Many of the

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[19] Carlton's (1979) results for SIC 367 are similar, except for a negative wage coefficient.

[20] Maintaining the Poisson assumption, a traditional Hausman (1978) test will indicate if the conditional mean is correctly specified. Under the alternative of misspecification, both ML and NLLS generally will be inconsistent and converge to different limits. These results are available from the author.

coefficients are smaller in magnitude than in the basic Poisson specification. This is due to a reduction in influence of the explanatory variables once unobservable state effects are controlled for. While these estimates are smaller, it is likely that they are consistent estimates of the direction of the economic effects. In addition, this technique has increased the number of coefficients with the expected sign.

The ETR is negative and significant in Apparel, Furniture and Communication Equipment but with smaller predicted economic effects than in the earlier Poisson specification. An increase of one percent (100 basis points) in the ETR leads to a 0.9, 2.6 and 9.7 decline in births in those industries, respectively. These estimates suggest a substantial elasticity of firm births with respect to business taxes, even in the presence of state fixed effects. The industries still differ widely in their response to tax differentials -- the ETR is a positive and significant influence on births in SIC 367. This industry is unresponsive, or responsive in an unexpected fashion to most of the measureable economic variables.

Wages reduce firm births in all industries except Electronic Components. A dollar per hour increase in wages leads to a 5.7 percent decline in births in Apparel. For Furniture, a similar wage increase leads to a 31.5 percent drop in births -- large and on par with earlier estimates but insignificant in the other industries.

The business service and climate coefficients are generally positively related to industrial activity as expected, although again, not in the Electronic Components industry. The remaining coefficients are of the expected sign once state effects are controlled for. For example, the land price coefficient is negative and significant in all five industries (in the basic Poisson model, four out of five industries had a positive coefficient). These estimates suggest that an increase in the price of land of $100 per

acre would reduce births in these industries from 2.4 to 15 percent, a sizable effect. The energy coefficients are sizable in this specification. They are negatively related to firm births in Furniture, Publishing and Communication Equipment suggesting a substantial decrease in births of 76, 19.6 or 19 percent due to an increase of $1 per million BTUs.

In summary, the coefficients of the Apparel, Furniture, Publishing and Communication Equipment industries suggest responses of reasonable magnitude. It should be emphasized that accounting for state heterogeneity in the second specification yielded estimates of the predicted sign. This technique reveals that several industries do respond to economic characteristics in their location process and, in particular, to the level of state and local business taxes. The Electronic Components industry does not appear to respond to differences in input costs across states. Electronic Components is found primarily in California and Massachusetts, neither state known for its low wages or tax costs. Clearly, the unmeasured state effect is dominant in this industry, for example, the Route 128 and Silicon Valley effects.

5. Conclusion

This paper presents estimates of a reduced form model of location for new single establishment manufacturing plants. Several results stand out. First, while previous research has had difficulty measuring the relationship between economic activity and the level of state wages and taxes, I find that economic factors do play a significant role in manufacturing location even after accounting for state heterogeneity. Second, industries differ markedly in their responsiveness to variation in state economic characteristics. A general statement concerning the responsiveness of manufacturing activity to high state taxes or wages is not possible. The results highlight the importance of accounting for unmeasured state heterogeneity in order to

obtain consistent estimates of tax effects.

These findings raise efficiency questions concerning state and local public finance. State and local governments continue to be sensitive to their level of business taxes; these results indicate that tax competition will have some effect on the composition of industry within the state. Estimates of the predicted change in the number of births caused by an increase in taxes, however, are found to be small. This suggests that the effects on business development may not be sizable enough to compensate states for revenue foregone. While there is no certain estimate of the costs associated with attracting industry, they are thought to be substantial. The effects of taxes varies by industry; this suggests that, at a minimum, incentive programs should be targeted at receptive industries. Clearly, the cost of attracting industry will vary by state and incentive employed; a logical next step would be to estimate the size (in terms of employment, tax revenue collected and other economy-wide effects) of these induced industry locations.

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Table 1. Total New Plant Births per Million Persons
1975-1982

State	Women's & Misses' Outerwear (SIC233)	Household Furniture (SIC251)	Book Printing & Publishing (SIC273)	Radio, TV & Comm. Eq. (SIC366)	Electronic Components & Accessories (SIC367)
AK	7.68	23.75	3.16	8.13	.45
CA	79.18	46.02	18.14	20.46	23.54
CT	16.53	21.68	21.31	16.90	6.25
FL	66.07	52.81	9.75	15.78	4.49
IL	7.70	13.62	13.63	8.05	3.80
IN	0.93	19.10	3.15	4.26	1.85
KS	3.84	14.49	5.97	6.39	1.28
KY	4.24	8.20	2.83	2.83	.85
MA	22.83	25.60	16.43	15.57	14.88
MI	1.64	13.31	4.47	6.11	3.16
MN	4.47	21.84	9.18	8.19	4.96
MO	6.17	18.93	7.41	8.85	2.47
NJ	44.86	13.87	10.74	11.28	5.71
NM	6.44	28.96	6.44	6.44	4.02
NY	150.68	19.73	20.57	8.43	4.67
NC	18.12	60.34	4.57	4.75	2.64
OH	2.05	11.82	6.79	8.19	2.42
PA	30.71	14.64	6.77	6.18	3.30
TN	20.40	37.41	5.67	4.76	1.36
TX	14.12	19.15	10.20	16.19	6.58
WA	4.12	32.66	11.32	14.92	5.66
WI	2.56	20.92	8.97	6.19	1.07
Sample Total	40.20	25.39	11.21	10.84	6.86

Source: The birth series is derived from the Small Business Administration's USEEM file.

Table 2. Selected Marginal Effective Tax Rates

	Apparel				Communication Eq.			
	ETR-A		ETR-B		ETR-A		ETR-B	
	1975	1982	1975	1982	1975	1982	1975	1982
AK	62.46	59.52	11.44	10.68	61.05	58.28	10.26	9.76
CA	63.27	60.56	12.58	12.09	62.94	60.06	13.14	12.35
CT	61.22	57.22	10.92	9.02	60.59	56.32	11.48	9.36
FL	60.73	58.25	8.75	8.77	59.52	56.98	8.68	7.80
IL	62.85	58.86	12.30	11.74	60.95	56.43	10.37	9.77
IN	62.09	62.28	11.11	15.06	60.78	59.98	10.09	12.52
KS	63.63	58.89	13.59	11.81	62.18	57.32	12.38	11.15
KY	61.20	58.37	9.45	8.88	59.80	57.14	8.28	7.99
MA	60.55	57.40	8.38	9.14	60.09	56.42	7.88	9.37
MI	67.02	61.67	18.16	15.97	64.11	58.26	14.67	12.55
MN	60.14	57.35	7.77	7.30	59.70	56.84	8.11	7.50
MO	63.26	57.97	12.93	10.36	61.38	56.19	11.03	9.36
NJ	61.26	57.49	9.75	9.39	61.02	56.51	10.44	9.62
NM	60.61	57.81	8.45	9.70	60.16	56.71	8.78	9.77
NY	60.12	56.31	7.87	7.48	59.40	54.96	7.77	7.08
NC	62.02	57.64	11.13	9.86	61.23	56.27	10.95	9.49
OH	60.43	56.72	8.34	8.24	59.82	55.61	8.44	8.31
PA	63.39	60.11	12.51	12.83	62.89	59.03	12.77	12.90
TN	60.55	56.60	8.64	8.13	59.78	55.23	8.49	7.75
TX	59.00	54.15	6.38	4.56	57.66	52.56	5.33	3.86
WA	59.48	55.88	7.05	7.26	58.93	54.87	7.23	7.46
WI	67.24	62.78	19.05	17.58	64.56	59.86	15.95	14.87

Note: The "A" series includes the Federal corporate income tax and deductibility of state and local taxes. The "B" series is composed of state and local taxes only. The ETRs are simulated with AFTAX.

Table 3. Summary Statistics on Variables (Industry Subsamples)

	MEAN	STD DEV	MINIMUM	MAXIMUM
Police & Fire Exp.	29.86	9.74	3.18	52.06
Land Price	3.73	2.03	.43	10.03
IRB Index	1.00	1.44	.00	8.79
Land Area	64.95	54.56	5.00	262.00
Energy	1.82	.46	.97	3.40
Population	7.49	5.31	1.15	24.72
Women's and Misses' Outerwear (SIC233)				
Firm Births	37.45	85.99	.00	472.00
Wages	2.10	.52	1.54	4.04
ETR	60.37	2.60	54.15	67.24
Household Furniture (SIC251)				
Firm Births	23.77	30.87	.00	201.00
Wages	2.49	.42	1.92	3.88
ETR	58.97	2.90	51.38	66.18
Book Printing and Publishing (SIC273)				
Firm Births	10.52	15.22	.00	83.00
Wages	3.07	.49	1.85	3.94
ETR	59.20	2.44	52.67	65.09
Radio, TV & Communication Eq. (SIC366)				
Firm Births	9.76	13.26	.00	86.00
Wages	2.97	.45	1.84	3.88
ETR	59.19	2.37	52.56	64.56
Electronic Components and Accessories (SIC367)				
Firm Births	6.44	14.55	.00	96.00
Wages	2.78	.35	1.84	3.88
ETR	59.33	2.81	52.21	66.35

Table 4. MLE Estimates of the Poisson Model

	Pooled Sample	Womens' Outerwear	Household Furniture	Book Printing	Comm. Equip.	Electronic Components
Constant	4.769	17.590	3.141	5.854	2.524	-4.230
	(.304)	(0.810)	(0.481)	(.973)	(.967)	(1.098)
Police & Fire Exp.	.021	.014	.0006	.043	.033	.058
	(.002)	(.003)	(.003)	(.005)	(.005)	(.008)
Land Price	-.003	-.029	.023	.064	.123	.085
	(.006)	(.010)	(.010)	(.015)	(.018)	(.020)
Irb Index	.004	.099	-.126	.048	.044	.101
	(.007)	(.012)	(.014)	(.021)	(.021)	(.031)
Land Area	-.0022	-.0080	-.0009	.0017	.0045	.0099
	(.0002)	(.0004)	(.0004)	(.0006)	(.0007)	(.0009)
ETR	-.027	-.260	.016	-.088	-.032	.012
	(.005)	(.013)	(.008)	(.017)	(.017)	(.019)
Wages	-.955	-.976	-.655	-.135	-.176	.156
	(.017)	(.086)	(.062)	(.073)	(.094)	(.144)
Energy	.280	1.027	-.031	-.044	-.040	.807
	(.040)	(.072)	(.072)	(.109)	(.117)	(.152)
Pop	.163	.257	.123	.107	.090	.079
	(.003)	(.006)	(.005)	(.008)	(.009)	(.011)
1976	-.090	-.063	.070	-.351	-.255	-.164
	(.028)	(.044)	(.053)	(.078)	(.082)	(.104)
1977	-.220	-.263	-.017	-.449	-.436	-.619
	(.029)	(.044)	(.055)	(.081)	(.088)	(.116)
1978	-.304	-.382	-.119	-.534	-.519	-.733
	(.030)	(.046)	(.057)	(.083)	(.089)	(.120)
1979	-.766	-1.504	-.421	-1.015	-.895	-1.034
	(.037)	(.065)	(.068)	(.107)	(.114)	(.145)
1980	-1.027	-2.155	-.688	-1.055	-.729	-1.155
	(.044)	(.084)	(.080)	(.126)	(.129)	(.178)
1981	-1.328	-2.850	-.877	-1.335	-1.010	-1.247
	(.052)	(.103)	(.092)	(.149)	(.155)	(.200)
1982	-1.989	-3.543	-1.434	-2.337	-1.650	-2.025
	(.059)	(.112)	(.105)	(.183)	(.180)	(.227)
Log Likelihood	-7386.2	-1288.9	-1086.3	-613.7	-645.6	-555.2

Note: A unit change in the independent variables leads to a percent change in births. For example, a dollar per hour increase in wages for SIC 233 leads to an 98 percent decline in births, while an increase of one percent (100 basis points) in the ETR leads to a 26 percent decline in births. Standard errors are in parentheses.

Table 5. Fixed Effects Estimation: Industry Subsamples

	Women's & Misses' Outerwear	Household Furniture	Book Printing & Publishing	Radio, TV & Comm. Eq.	Elect. Comp. & Access.
Police &	-.002	.00005	.004	.002	-.011
Fire Exp.	(.0006)	(.0015)	(.002)	(.003)	(.004)
Land	-.030	-.024	-.152	-.088	-.136
Price	(.009)	(.010)	(.013)	(.016)	(.034)
IRB Index	.034	.011	-.091	.049	.029
	(.005)	(.009)	(.017)	(.018)	(.032)
ETR	-.009	-.026	.016	-.097	.045
	(.004)	(.005)	(.014)	(.017)	(.022)
Wages	-.057	-.315	-.116	-.043	.148
	(.022)	(.032)	(.095)	(.046)	(.116)
Energy	.315	-.764	-.196	-.190	-.035
	(.017)	(.028)	(.049)	(.054)	(.084)
Pop	-.006	.044	.167	.062	.028
	(.007)	(.009)	(.013)	(.015)	(.027)
1976	-.059	.114	-.184	-.121	.116
	(.004)	(.008)	(.015)	(.016)	(.022)
1977	-.159	.133	-.242	-.263	-.211
	(.005)	(.011)	(.018)	(.024)	(.037)
1978	-.181	.087	-.229	-.232	-.074
	(.006)	.014	(.025)	(.030)	(.050)
1979	-.503	-.181	-.427	-.755	-.253
	(.011)	.024	(.056)	(.065)	(.098)
1980	-.774	-.179	-.486	-.573	-.187
	(.013)	(.029)	(.069)	(.072)	(.116)
1981	-1.014	-.284	-.611	-.882	-.044
	(.019)	(.035)	(.086)	(.085)	(.127)
1982	-1.566	-.772	-1.594	-1.513	-.622
	(.019)	(.039)	(.095)	(.094)	(.142)
Log Likelihood	-13307	-8411	-3686	-3471	-2308

Note: A unit change in the independent variables leads to a percent change in the number of births. For example, in SIC 233, an increase in the wage of one dollar per hour causes a decline in births of 5.7 percent and one percent (100 basis points) increase in the ETR causes births to decline by .9 percent. Standard errors are in parentheses.

Appendix: Calculation of Effective Tax Rates on Business

Measures of average tax rates may provide little information on the pattern of marginal tax incentives facing new investments (see Auerbach, 1983 for a discussion). The marginal ETR is the preferred measure of the incentive effects of taxation. The ETR used in this analysis is based on the neoclassical theory of capital accumulation and the user cost of capital notion initially developed by Hall and Jorgenson (1967). Arbitrage between selling debt and buying an equal amount of real capital determines the equilibrium relationship among i, the nominal interest rate, q, the purchase price of one unit of capital and c, the rental rate. In equilibrium, the present value of the nominal cash flow from a unit of capital must equal the initial outlay.

$$(1-k)q = \int_0^\infty (1-u)ce^{(\pi-\delta)\tau} e^{-(1-u)i\tau} d\tau + \int_0^\infty uq\delta' e^{-\delta'\tau} e^{-(1-u)i\tau} d\tau$$

where u = corporate tax rate

k = investment tax credit

π = rate of inflation

δ' = rate of depreciation for tax purposes

δ = rate of economic depreciation

A discrete time approximation to this integral is used to find the ETR. Given a pretax, risk neutral rate of return ρ of 20 percent and a series of net of tax cash flows over a fixed time period, say 20 years, the following equation may be used to define s, the after-tax rate of return:

$$C_0 + C_1/(1+s) + C_2/(1+s)^2 + \ldots + C_{20}/(1+s)^{20} = 0.$$

The after-tax rate of return s, is that discount rate (internal rate of return) which makes the net present value of the marginal investment equal to zero. The ETR is then defined to be $[(\rho-s)/\rho]*100$.

These calculations are carried out by the simulation model AFTAX. AFTAX simulates the operation of a representative firm over a 20 year

period, tracking investment and depreciation and calculates ρ and s for a marginal investment in a particular state. A brief description of AFTAX follows; a detailed account is in Papke (1989).

i. An Overview of the Simulations

The AFTAX simulations are conducted for sets of representative or typical corporations endowed with a specified capital asset composition and operating characteristics. The firm operates across several states over its lifetime with an assumed before-tax rate of return of 20 percent on capital investments. Gross income is equal to the product of the rate of return and the value of assets. Sales are made at an explicitly defined instate/outstate ratio. All depreciable assets are tracked, applying appropriate depreciation methods, over their useful lives in separate vintage accounts to allow for annual property tax calculations.

Annual tax costs are calculated over the firm's life. The annual after-tax cash flows are computed. A complete longitudinal tax history is generated for the 20 year period. The firm then makes an additional investment of a fixed percentage of its original assets in the same location. A second simulation generates after-tax returns for the expanded firm. The differences in the two simulations are calculated, and the discount rate which equates the present value of the differences with the cost of the new investment is computed. The discount rate is the after-tax rate of return on the new investment at that site. It provides an unambiguous measure of comparison of the tax consequences of investment in any location.[21]

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[21]Thus, rather than assuming an interest rate with which to discount cash flows, AFTAX finds the discount rate which makes the net present value of the investment equal to zero. In the finance literature, this discount

Two general sets of conditions interact to determine the resulting after-tax rate of return. One is the financial and operating parameters of the firm: asset composition, investments, economic depreciation, gross income, geographic location of productive facilities and the distribution of sales. The second set encompasses all the tax parameters and definitions relevant to the calculation of tax liability.

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rate is called the internal rate of return (IRR) on a project. It is a profitability measure which depends solely on the amount and timing of the project cash flows. The rule for capital budgeting on the basis of the IRR is to accept an investment project if the opportunity cost of capital (i.e., the rate of return in an alternative investment of equivalent risk) is less than the IRR.

Various assumptions written into AFTAX guarantee that problems commonly associated with use of the IRR as a measure of profitability will not occur. The annual cash flows do not change sign, the investment is internally financed, mutually exclusive projects are not at issue, and no use is made of interest rates.